MODIS Science Team Member

Semi-Annual Report

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FOCUS ACTIVITIES DURING THE REPORTING PERIOD

The most important activities undertaken during this reporting period are the following:

1. Land surface reflectance code development, testing and delivery.
2. Test sites logging in Level 2 MOD PR09 code.
3. MOD_PR09 ATBD update.
4. MOD_PR09 QA activity.
5. MOD_PR09 validation activity.
6. Improvements to the MODIS synthetic data generator.
7. Aerosol climatology.
8. Validation of aerosol retrieval from AVHRR and SeaWiFS data.
9. MODIS Adaptive Processing System (MODAPS).
10. Participation in X-Day, TESS and MODAPS testing.

1. Land surface reflectance code development, testing and delivery

Our Science Computing Facility (SCF) testing of the L2 land surface reflectance code lead to the identification of areas where the code was modified to improve its robustness and performance. These areas include:

A. Checking the Automatic Quality Flag and warn if it is set to other than ‘passed’.
B. Adding code to check all of the fill values included in the geo-location product.
C. Allowing the code to perform atmospheric correction over clouds (always) and over water bodies (when specified in the Process Control File (PCF)).
D. Adding code that prints intermediate data for a set of locations defined in the PCF to help in the in-house evaluation of the surface reflectance product.
E. Adding Quality Flag field descriptions to the meta data.
F. Modifying the local granule ID in the 8-day product to reflect the period theoretically covered by the product.

To improve the way the surface reflectance code uses MODIS aerosol product, we worked with the Atmospheres Group (Rich Hucek) on modifying the format of the L3 orbital aerosol interim product (MOD_PR04ORB) used solely by MOD_PR09 code. The surface reflectance code was also modified to interface with this new format.

In light of talks about the unavailability of some DAO data at launch, MOD_PR09 code was modified to ingest ancillary data in the GRIB format to enable using NCEP data where DAO data are unavailable.

MOD_PR09 code was also modified to read the new MODIS Level 1B format as defined by MCST. Given that a large chunk of the synthetic data is available in the original L1B format, we opted to support both formats. MOD_PR09 code selects the format to be used based on the ‘PGEVERION’ field read from the L1B metadata. The first version of the code with this feature (V2.2.11) was delivered to SDST in March 99.

2. Test sites logging in Level 2 MOD_PR09 code

To help with the evaluation and validation of MOD_PR09 product, we improved the implementation of the test sites logging available in the code. A list of test sites identified by their name and defined by the upper left and lower right corners is stored in a file and passed to the code through the PCF interface. All reflectance, atmospheric and geometric data statistics are written to the global meta-data of MOD_PR09.

3. MOD_PR09 ATBD update

The land surface Algorithm Theoretical Basis Document (ATBD) has been updated to reflect changes in the algorithm. Version 4.0 of the ATBD was delivered in April '99 and can be accessed through the MODIS ATBD's homepage:

http://modarch.gsfc.nasa.gov/MODIS/ATBD/atbd_mod08.pdf

4. MOD_PR09 QA activity

A new version of MOD_PR09 QA plan (Version 2.1.3) has been developed to take into consideration the results of the SCF and the Land Data Operational Product Evaluation (LDOPE) scientists' review. The new plan includes in addition to the previous version:

- A list of output product ID's.
- Resolution and SDS names of input products.
- QA flag bits description.
- Downstream MODLAND product dependencies.

Already developed tools to help perform QA on the MOD_PR09 product were refined. A new tool to derive a coarse resolution surface reflectance product from Level 1B data was developed.

5. MOD_PR09 validation activity

Our SCF scientists are involved in the deployment of the CIMEL sun-photometers at EOS land validation core sites. Twenty two of these sites either have an AERONET sun-photometer already installed or is scheduled to have one soon. Information about the location of these sites can be obtained from

http://modarch.gsfc.nasa.gov/MODIS/LAND/VAL/EOSaeronet.html .

6. Aerosol climatology

The team continued the effort to derive an aerosol climatology using AERONET measurements for use in MODIS data atmospheric correction and land surface reflectance validation. The monthly average aerosol optical thickness (AOT) was computed for all of the 24 EOS Land validation core sites using the AERONET database.

The graph below is an example of data available from the Sevilleta (NM) and USDA (Beltsville, MD) sites. The upper part of the graph shows the monthly average AOT at 440 nm as well as the standard deviation. The lower part of the graph gives the observation frequency (the number of observations per day and the number of days when data was collected). Note that the data are not cloud screened, and that the last few months of data may not have final calibration.

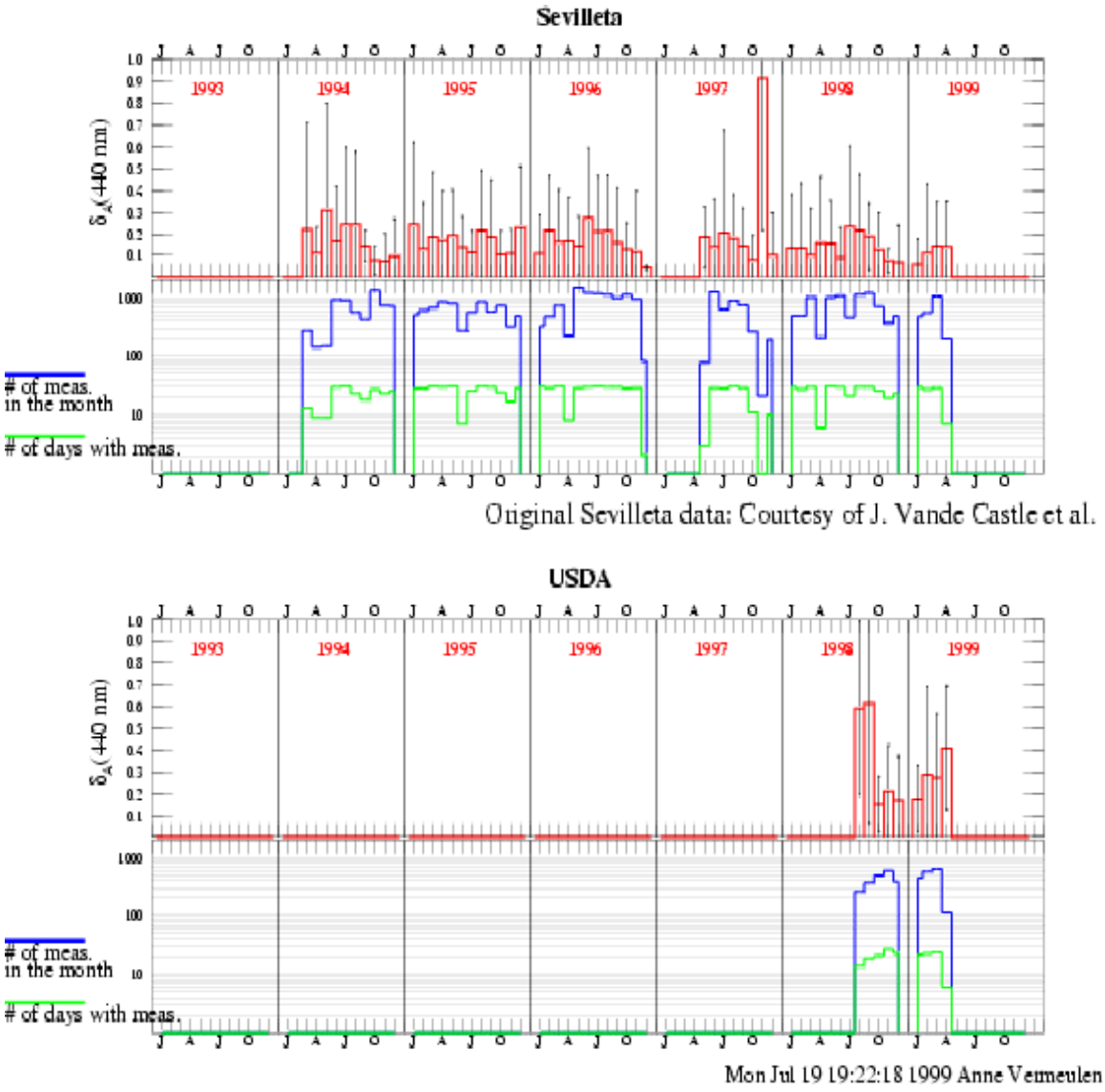


Figure 1: Examples of statistics computed using AERONET data for the EOS validation core sites (J = January, A = April, J = July, O = October).

7. Validation of aerosol retrieval from AVHRR and SeaWiFS data

Work on aerosol retrieval over land and ocean from AVHRR and SeaWiFS continues, where data over some aeronet sites were collected to help in the validation process. Aerosol optical thickness (AOT) over ocean was retrieved using SeaWiFS data. The results were compared to AOT measured by the sun-photometer.

Figure 3a: Comparison of SeaWiFS aerosol optical thickness retrieval at 870nm with sun-photometer data from AERONET.

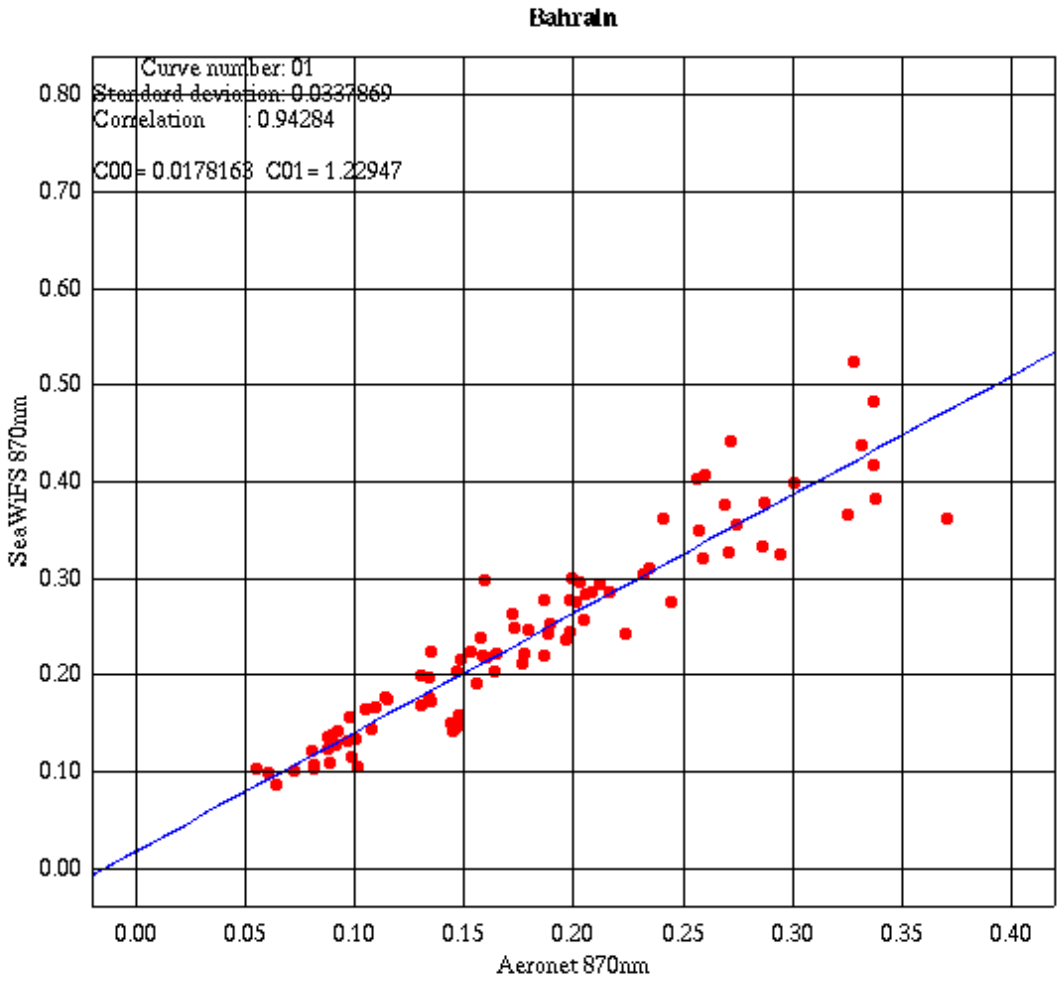
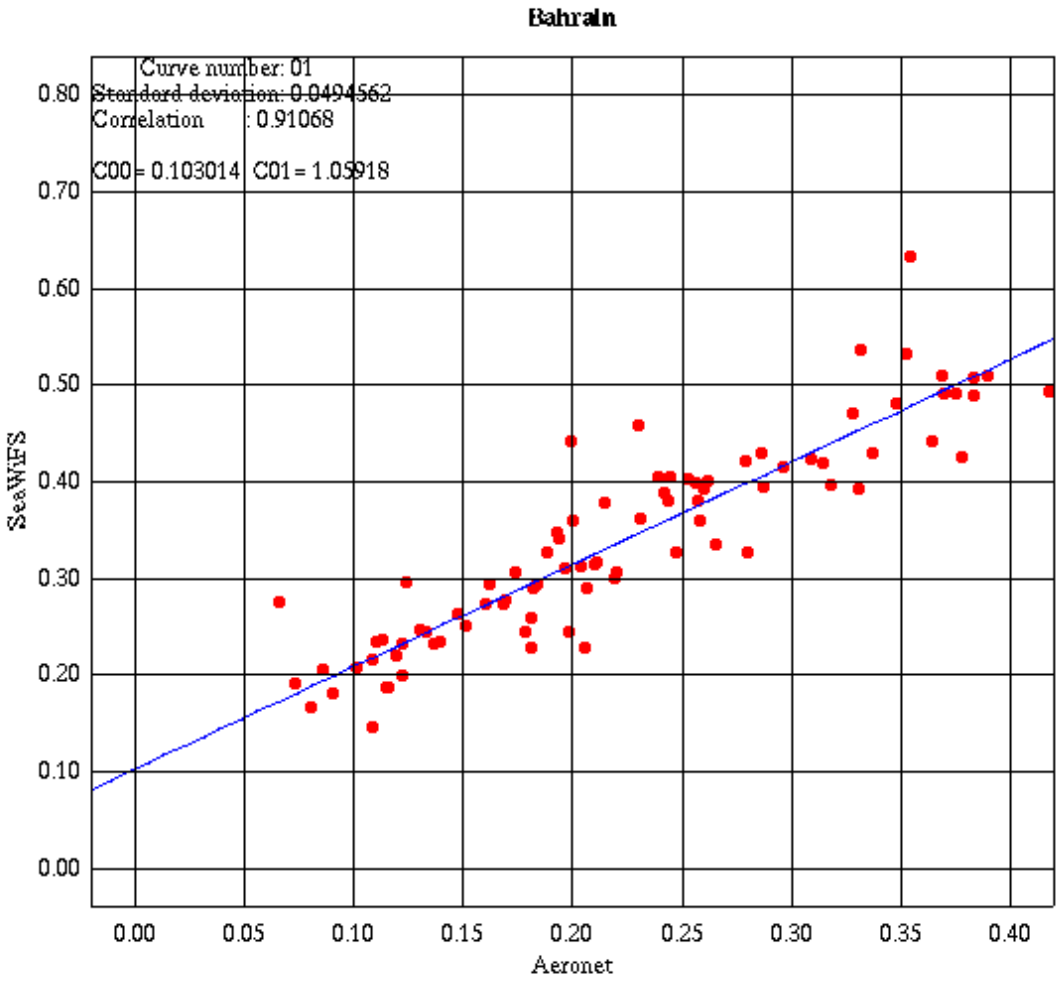


Figure 3b: Comparison of SeaWiFS aerosol optical thickness retrieval at 670nm with sun-photometer data from AERONET. The relatively large intercept is attributed to SeaWiFS calibration problem.



8. MODIS Adaptive Processing System (MODAPS)

We participated in the PI-led processing activity where Eric Vermote was selected as the Land Team representative. He currently chairs the monthly PI Processing Meetings.

Our SCF personnel participated in reviewing the MODAPS requirements and design materials, as well as in the periodic reviews and walk-throughs throughout the integration and test phase. We also worked with the MODAPS team to help alleviate any problems flagged at any stage of the development, integration or test.

Our SCF played an important role in refining and producing the land part of the MODIS synthetic data set. A particular effort was invested in integrating a physical model (KUUSK model) whose parameters are based on remote sensing data (SeaWiFS), to compute the synthetic surface contribution in the visible and near infrared region.

We tracked the progress in MODAPS development and testing through our participation in the weekly MODAPS Status Meeting as well as daily teleconferences when scheduled testing was taking place.

9. Participation in X-Day, TESS and MODAPS testing

Our SCF was very active in the design, preparation and implementation of the X-day test where lessons learnt from the WILT test were used to generate more products. In preparation for the test, we participated in producing the synthetic data set, settings and also trying out the interface to our SCF. During the test, we monitored daily progress by participating in daily status meetings and helping to set the day to day plan. We also used the generated products to perform a post-production QA activity. We shared our findings with the MODAPS team.

We also participated in reviewing the ESDIS defined Terra test (TESS) requirements and in carrying out the test.

A. MEETINGS ATTENDED

- Reflective Band Workshop, Feb 11-12, 1999
- VIIRS Science Team Meeting, Feb 24, 1999
- Aerosol Working Group Meetings,

  Mar 16, May 6, May 27, 1999 GSFC, Greenbelt, MD.
- MODLAND SDST Meeting, Mar 30-31, 1999 GSFC.
- TESS Preparation Meeting GDAAC/MODAPS April 16,1999
- TESS Preparation Meeting GDAAC/MODAPS April 19,1999
- TESS Preparation Meeting GDAAC/MODAPS April 20,1999
- TESS Preparation Meeting GDAAC/MODAPS April 21,1999
- TESS Preparation Meeting GDAAC/MODAPS April 22,1999
- MODIS Science Team Meeting, May 4-5, 1999 Greenbelt, MD.
- MODLAND Day, May 6, 1999 Greenbelt, MD.
- MODAPS V2 Archiver Review, May 14,1999
- MODAPS V2 Loader and Re-processing, May 21,1999
- DAAC Teleconference, May 28,1999
- MOSS-2 Coordination Meeting, May 13, 1999 GSC, Lanham, MD.
- MODAPS V2 Archiver Working Review, May 14, 1999 GSC, Lanham, MD.
- MODAPS V2 Reprocessing Loader Review, May 21, 1999, GSC, Lanham, MD.
- MODAPS V2 Archiver Detailed Design Review, June 22,1999, GSC, Lanham, MD
- NPOESS/ System Functional Review, Raytheon, Forbes Blvd, Lanham, MD.
- Monthly PI Processing Status Meetings, NASA/GSFC.
- Weekly Technical Team Meetings, NASA/GSFC.
- Weekly MODIS L1 Integration Meetings.
- Weekly MODAPS Status Meetings, GSC, Lanham, MD

- Weekly SDDT (Science Data Discipline Team) Meetings.
- Daily MODAPS Testing Status Teleconference (only when in test).
- Weekly MODIS/EDC Teleconference.
- The International Conference and Workshops on Ocean Color, Land Surfaces, Radiation and Clouds, Aerosols, ALPS '99, Jan 18-22, 1999, Meribel, France.

B. PUBLICATIONS /PRESENTATIONS

El Saleous N.Z., **Vermote E.F**., Justice C.O., Townshend J.R., Tucker C.J., Goward S.N., 1999, Improvements in the global biospheric record from the Advanced Very High Resolution Radiometer (AVHRR), International Journal of Remote Sensing, (accepted for publication)

Ouaidrari H. and **E. Vermote**, 1999, Operational Atmospheric Correction of Landsat TM data", Remote Sensing of Environment, Special Issue, In press.

Vermote E.F. and **Anne Vermeulen**, April 1999, MODIS atmospheric correction algorithm: spectral reflectances, Algorithm Technical Background Document, Version 4.0.

Vermeulen A., Vermote E., Descloitres J., Mao-Che I., and Holben B., 1999, Mapping monthly estimation of aerosol optical thickness from sun-photometer and satellite measurements. *Proceedings of the International Conference and Workshops on Ocean Color, Land Surfaces, Radiation and Clouds, Aerosols, ALPS '99: The contribution of POLDER and new generation spaceborne sensors to global change studies*, WK1-P-31, Meribel, France.

Vermeulen A., Devaux C., and Herman M., 1999, Retrieval of the phase function and the polarized phase function of aerosols from ground-based measurements. *Proceedings of the International Conference and Workshops on Ocean Color, Land Surfaces, Radiation and Clouds, Aerosols, ALPS '99: The contribution of POLDER and new generation spaceborne sensors to global change studies*, WK1-O-20, Meribel, France.

O' Neill N. O., Holben B.N.,**Vermote E.F**., Royer A., Aube M., Blanchet J.P., Spacek L., January 1999, Comparison between the aerosol transport simulation of an RCM and spatio-temporal measurements of the aerosol optical parameters, Proceeding of the Conference and Workshop on the contribution of POLDER and the new generation of spaceborne sensors to global change studies, Meribel, France,.

Kinne S.,**Vermote E.F**., Torres O., Holben B.N., Stowe L., Prins E., Veefkind P., Hobbs P., Hignett P., Russel P., January 1999, Intercomparison and validation of satellite based aerosol data , Proceeding of the Conference and Workshop on the contribution of POLDER and the new generation of spaceborne sensors to global change studies, Meribel, France.

Descloitres J. and **Vermote E.F**., January 1999, Operational retrieval of the spectral surface reflectance and vegetation index at global scale from SeaWiFS data, Proceeding of the Conference and Workshop on the contribution of POLDER and the new generation of spaceborne sensors to global change studies, Meribel, France.

Sobrino J.A., Dempere L.,**Vermote E.F**., Cuenca,J., 1999, Correction for aerosol effects on satellite sea surface temperatures, Proceeding of SPIE, International Society for Optical Engineering, Volume 3495, (In press).

Vermote E.F.et al., January 1999, Aerosol remote sensing with AVHRR and SeaWiFS, Conference and Workshop on the contribution of POLDER and the new generation of spaceborne sensors to global change studies, Meribel, France, (invited).

C. GLOSSARY

AERONET	AErosol RObotic NETwork
ARS	Agricultural Research Site
ASD	Analytical Spectral Devices
ATBD	Algorithm Theoretical Basis Document
AVHRR	Advanced Very High Resolution Radiometer
BRDF	Bidirectional Reflectance Distribution Function
CIMEL	CIMEL Electronic is a company based in Paris, France
DAO	Data Assimilation office
EDC	EROS Data Center
ESDIS	EOS Science Data Information System
GRIB	GRI in Binary
GSC	General Science Corporation
GSCF	Goddard Space Flight Center
ID	IDentifier
L1B	Level 1B
L2	Level 2
L3	Level 3
LDOPE	Land Data Operational Production Evaluation
MCST	MODIS Characterization Support Team
MODAPS	MODIS Adaptive Processing System
MODIS	MODerate Imaging Spectro-radiometer
MODLAND	MODIS Land team
MOSS-2	Mission OPS and Science System 2
NCEP	National Centers for Environmental Prediction
OPS	OperationS
PI	Principal Investigator
PCF	Process Configuration File
QA	Quality Assurance
SCF	Science Computing Facility
SDS	Science Data Set

SDST	Science Data Support Team
SDDT	Science Data Discipline Team
SeaWiFS	Sea Wide Field of view Sensor
TESS	Terra End to end Science System test
USDA	United States Department of Agriculture
WILT	Week in the LIfe Test